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STS 22

EU-China Aeronautics Research Cooperation – Part 1: Drag Reduction in Turbulent Boundary Layer via Flow Control

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Session Abstract

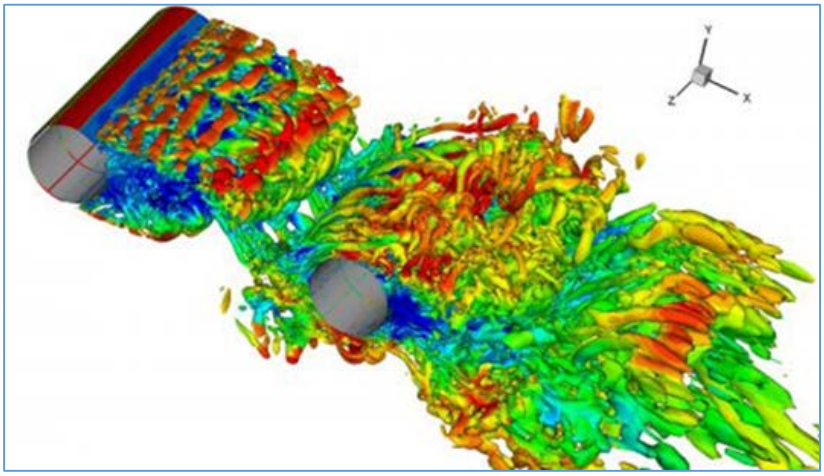
Keywords: *Aircraft drag reduction, turbulent boundary layer control, flow-control technique*

Within the EU-China research cooperation in aeronautics, the joint EU-China project DRAGY addressed the problem of drag reduction of aircraft through the investigation of flow-control techniques. Almost 50% of total drag is related to the friction drag of the aircraft caused by the interaction of the airflow with the aircraft surface. Studies on the aircraft and flow interactions, together with developments of advanced flow-control technologies, can effectively reduce about 15% of the total drag, which has, therefore, major implications on fuel consumption.

In addition, by using new algorithms and exploiting efficiently large computing facilities, the project is improving the understanding of the underlying physics behind the control techniques and their interaction with the airflow near the aircraft surface (i.e. the boundary layer) to maximize their efficiency.

Turbulent Boundary Layer Control for skin-friction drag reduction is a relatively new technology made possible through the advances in computational-simulation capabilities, which have improved our understanding of the flow structures of turbulence. Advances in micro-electronic technology have enabled the fabrication of actuation systems capable of manipulating these structures. The combination of simulation, understanding and micro-actuation technologies offer new opportunities to significantly decrease drag, and by doing so, increase fuel efficiency of future aircraft.

Almost 50% of total drag is due to the viscous drag, which is directly related to the friction drag of the aircraft caused by the interaction of the turbulent boundary layer flow with the aircraft surface. Studies showed, that turbulent boundary layer interactions, together with developments of advanced flow-control technologies, can effectively reduce more than 40% of the viscous drag (if the actuation power is ignored), which is equivalent to about 15% of the total aircraft drag. Therefore, it has major implications to fuel consumption of commercial aircraft, already if a small proportion of this reduction level is realised.



List of tentative paper titles and speakers of STS 22:

Introduction to the EU-China Project DRAGY and the STS Objectives (10-15min)
Adel Abbas, adel.abbas@upm.es
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Canalizing Large-Scale Turbulent Boundary Layer Flow Structures by Imperfect Synthetic Jet Actuation (25 min.)
Markus Rütten, markus.ruetten@dlr.de
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DRAGY Flow Control Observed Benefit on Aircraft Level (25min.)
Richard Ashworth, richard.ashworth@airbus.com
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Bristol, U.K.

Drag Reduction Control in Turbulent Channel with Spanwise Traveling Wave of Blowing and Suction (25 min.)
Song Fu, fs-dem@mail.tsinghua.edu.cn
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